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04/16/99

Jc572 U.S. PTO

NEW, CONTINUATION, DIVISIONAL OR  
CONTINUATION-IN-PART APPLICATION  
UNDER 37 C.F.R. §1.53(b)

Attorney Docket No. 0275D-000247  
Express Mail Label No. EJ 510 630 367 US  
Date April 16, 1999

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOX PATENT APPLICATION  
Assistant Commissioner for Patents  
Washington, D. C. 20231

Jc625 U.S. PTO  
09/293455  
04/16/99

Sir:

Transmitted herewith for filing under 37 C.F.R §1.53(b) is a patent application for

ARMATURE SHAFT RETAINER

identified by: ☐ First named inventor \_\_\_\_\_  
or ☒ Attorney Docket No. (see above)

1. Type of Application

- ☒ This application is a new (non-continuing) application.
- ☐ This application is a ☐ continuation / ☐ divisional / ☐ continuation-in-part of prior application No. \_\_\_\_\_. Amend the specification by inserting before the first line the sentence:
- This is a [continuation/division/continuation-in-part] of United States patent application No. \_\_\_\_\_, filed \_\_\_\_\_--
- ☐ The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied, is considered part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

If for some reason applicant has not requested a sufficient extension of time in the parent application, and/or has not paid a sufficient fee for any necessary response in the parent application and/or for the extension of time necessary to prevent the abandonment of the parent application prior to the filing of this application, please consider this as a Request for an Extension for the required time period and/or authorization to charge Deposit Account No. 02-2548 for any fee that may be due. THIS FORM IS BEING FILED IN DUPLICATE.

2. Contents of Application

- a. Specification of twelve pages;
- ☐ A microfiche computer program (Appendix);
- ☐ A nucleotide and/or amino acid sequence submission;
- ☐ Because the enclosed application is in a non-English language, a verified English translation ☐ is enclosed ☐ will be filed.
- ☐ Cancel original claims \_\_\_\_\_ of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing date purposes.)
- b. ☒ Drawing **Figures 1 through 3** on two (2) sheets;

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- c. ☒ A signed Oath/Declaration ☐ is enclosed / ☒ will be filed in accordance with 37 C.F.R. §1.53(f).

The enclosed Oath/Declaration is ☐ newly executed / ☐ a copy from a prior application under 37 C.F.R. §1.63(d) / ☐ accompanied by a statement requesting the deletion of person(s) not inventors in the continuing application.

d. **Fees**

FILING FEE	Number				Number				Basic Fee
CALCULATION	Filed				Extra		Rate	\$760.00	
Total Claims	21	-	20	=	1	×	\$18.00	= 18.00	
Independent Claims	3	-	3	=	0	×	\$78.00	= 00.00	
Multiple Dependent Claim(s) Used							\$260.00	=	
FILING FEE - NON-SMALL ENTITY								778.00	
FILING FEE - SMALL ENTITY: Reduction by 1/2									
[ ] Verified Statement under 37 C.F.R. §1.27 is enclosed.									
[ ] Verified Statement filed in prior application.									
Assignment Recordal Fee (\$40.00)									
37 C.F.R. §1.17(k) Fee (non-English application)									
TOTAL								778.00	

- ☐ A check is enclosed to cover the calculated fees. The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment, to Deposit Account No. 02-2548. A duplicate copy of this document is enclosed.
- ☐ The calculated fees will be paid within the time allotted for completion of the filing requirements.
- ☒ The calculated fees are to be charged to Deposit Account No. 02-2548. The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment, to said Deposit Account. A duplicate copy of this document is enclosed.

3. **Priority Information**

- ☐ **Foreign Priority:** Priority based on \_\_\_\_\_ Application No. \_\_\_\_\_, filed \_\_\_\_\_, is claimed.
- ☐ A copy of the above referenced priority document ☐ is enclosed / ☐ will be filed in due course, pursuant to 35 U.S.C. §119(a)-(d).
- ☐ **Provisional Application Priority:** Priority based on United States Provisional Application No. \_\_\_\_\_, filed \_\_\_\_\_, is claimed under 35 U.S.C. §119(e).

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**4. Other Submissions**

☐ A Preliminary Amendment is enclosed.

☐ An Information Disclosure Statement, \_\_\_\_\_ sheets of PTO Form 1449, and \_\_\_\_\_ patent(s)/publications/documents are enclosed.

☒ An unsigned power of attorney

☒ is submitted ☒ with the new Oath/Declaration.

☐ is of record in the prior application and ☐ is in the original papers / ☐ a copy is enclosed.

☐ An Assignment of the invention

☐ is enclosed with a cover sheet pursuant to 37 C.F.R. §§3.11, 3.28 and 3.31.

☐ is of record in a prior application. The assignment is to \_\_\_\_\_, and is recorded at Reel \_\_\_\_\_, Frame(s) \_\_\_\_\_.

☐ An Establishment of Assignee's Right To Prosecute Application Under 37 C.F.R. §3.73(b), and Power Of Attorney is enclosed.

☒ An Express Mailing Certificate is enclosed.

☐ Other: \_\_\_\_\_  
\_\_\_\_\_

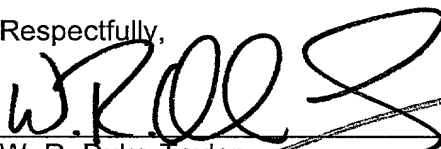
Attention is directed to the fact that the correspondence address for this application is:

Harness, Dickey & Pierce, P.L.C.  
P.O. Box 828  
Bloomfield Hills, Michigan 48303  
(248) 641-1600.

Dated: April 16, 1999

Harness, Dickey & Pierce, P.L.C.  
P.O. Box 828  
Bloomfield Hills, Michigan 48303  
(248) 641-1600

Respectfully,

  
\_\_\_\_\_  
W. R. Duke Taylor  
Reg. No. 31306

## ARMATURE SHAFT RETAINER

### BACKGROUND OF THE INVENTION

The present invention relates to power tool motors and, more particularly, to a retainer which maintains the armature shaft positioned within the stator assembly of the motor.

5 In manufacturing electric motors, it is important to have proper alignment between the armature, which includes the rotor and commutator, with the brushes and stator assembly. Proper alignment prohibits axial movement or end play which may occur in the motor when the armature shaft is positioned within the motor. Excessive axial shifting is known to cause  
10 noise, vibration, and excessive wear during operation. Thus, it is desirable to limit axial movement of the armature shaft in the motor.

In the past, the armature shaft has included a groove with slip rings, such as C-rings, as well as washers to maintain the axial integrity of the shaft. However, these types of connections have enables more axial play than is  
15 desired in the shaft. Thus, it would be desirable to maintain the axial integrity of the armature shaft within the motor. Also, it would be desirable to provide a registration point so that the commutator and rotor could be positioned along the shaft.

Accordingly, it is an object of the present invention to provide a retainer  
20 for an armature shaft which maintains the axial integrity of the shaft within the stator assembly of the motor. Also, the present invention provides the art with a retainer which is maintained within a bearing. The retainer and bearing are flush with the end of the armature shaft to provide registration for the armature shaft components. The present invention also provides the art with an

inexpensive and efficient device to maintain the armature shaft within the stator assembly.

In accordance with a first aspect of the invention, an armature shaft comprises a shaft which has two ends. A commutator is positioned on the shaft. At least one bearing is on the shaft and is adjacent one of the ends of the shaft. The bearing has a central bore sized to balance the shaft during rotation. The central bore also has an enlarged diameter portion. A retainer is positioned on the shaft to retain the bearing on the shaft. The retainer is positioned within the enlarged bore portion of the bearing. A bearing housing surrounds the bearing and is adapted to fix with an end plate of the motor. The bearing housing has a receiving bore to receive the bearing. The bearing housing has a stepped configuration. The bearing likewise has an outer configuration which is stepped to fit within the housing. The bearing and retaining member are flush with the end of the shaft. Also, the enlarged bore portion defines an abutting shoulder which abuts against an end of the retainer.

In accordance with a second embodiment of the invention, an electric motor comprises a stator assembly with an armature rotatable within the stator assembly. A commutator is rotatable with the armature and is connected to the armature via a shaft. Brushes are associated with the commutator and the brushes are held on an end plate of the motor. At least one bearing is on the shaft and is adjacent one of the ends of the shaft. The bearing has a central bore sized to balance the shaft during rotation. The central bore also has an enlarged diameter portion. A retainer is positioned on the shaft to retain the bearing on the shaft. The retainer is positioned within the enlarged bore

portion of the bearing. A bearing housing surrounds the bearing and is fixed to the end plate of the motor. The bearing housing has a receiving bore to receive the bearing. The bearing housing has a stepped configuration. The bearing likewise has an outer configuration which is stepped to fit within the bearing housing. The bearing and retaining member are flush with the end of the shaft. Also, the enlarged bore portion defines an abutting shoulder which shoulder abuts against the retainer. A second bearing is at the other end of the shaft.

In accordance with a third embodiment of the present invention, a power tool comprises a housing. A motor is positioned within the housing. The motor includes a stator assembly with an armature rotatable within the stator assembly. A commutator is rotatable with the armature and is connected to the armature via a shaft. Brushes are associated with the commutator and the brushes are held on an end plate of the motor. At least one bearing is on the shaft and is adjacent one of the ends of the shaft. The bearing has a central bore sized to balance the shaft during rotation. The central bore also has an enlarged diameter portion. A retainer is positioned on the shaft to retain the bearing on the shaft. The retainer is positioned within the enlarged bore portion of the bearing. A bearing housing surrounds the bearing and is fixed to the end plate of the motor. The bearing housing has a receiving bore to receive the bearing. The bearing housing has a stepped configuration. The bearing, likewise, has an outer configuration which is stepped to fit within the bearing housing. The bearing and retaining member are flush with the end of the shaft. Also, the enlarged bore portion defines an abutting shoulder which shoulder abuts against the retainer. Also, a power source is electrically

coupled with the motor. An activation member is electrically coupled with the motor and the power source to energize and de-energize the motor. An output is coupled with the motor to drive a tool.

Additional objects and advantages of the invention will become apparent from the detailed description of the preferred embodiment, and the appended claims and accompanying drawings, or may be learned by practice of the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a plan view partially in section of a power tool in accordance with the present invention.

Figure 2 is a cross-section view of the motor assembly within the Circle 2.

Figure 3 is an enlarged cross-section view of Figure 1.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning to Figure 1, a power tool in accordance with the present invention is illustrated and designated with the reference numeral 10. The power tool is illustrated as a drill; however, any type of power tool such as a screwdriver, sander, rotary tool, clippers, saw or the like which utilize an electrical motor may use the motor of the present invention. The power tool 10 includes a housing 12 which surrounds a motor 14. An activation member 16 is coupled with the motor 14 as well as with a power source 18. The power source 18 may be a battery (DC current) or the power tool may have a power

cord (AC current) as shown. The motor 14 is also coupled with an output 20 which may include a chuck 22 and a transmission 24.

Turning to Figures 2 and 3, the motor 14 is better illustrated. The motor 14 includes a stator assembly 30 which includes a housing 32 and magnets 34 and 36. An armature 40 includes a shaft 42, a rotor 44 with plates 46 and windings 48, as well as a commutator 50 coupled onto the shaft 42. The motor also includes end plates 52 and 54. End plate 52 includes a bearing 56 which balances one end of the shaft 56 onto the shaft which is coupled with a power takeoff 58.

The end cap 54 includes brushes 62 and 64 which are associated with the commutator 50. The end cap 54 includes a unitary bearing housing 70. The bearing housing 70 defines an overall cylindrical cavity 74. The cavity includes a stepped shoulder 76. The bearing housing 70 houses a bearing 80.

The bearing 80 has a central bore 82 which is sized to balance the armature shaft 42. The central bore 82 has an enlarged diameter portion 84 at one of its ends. A shoulder 86 is formed at the junction of the two bore portions. The bearing 80 has an outer surface 88 which is defined by a pair of concentric cylinders 90, 92. The cylinders are configured to fit within the bearing housing 70 and have shoulder 94 abut with shoulder 76 of the housing 70.

A retainer 100 is press fit onto the shaft 42. The retainer 100 is an annular member formed from a press metal material including desired lubricant properties. The retainer 100 fits within the enlarged bore portion 84 of the bearing 80. Thus, the retainer 100 and bearing 80 are flush with the end 102 of the shaft 42. The retainer 100 seats on the bearing shoulder 86 to provide



registration of the bearing 80. Also, the retainer 100 provides registration for the commutator 50 as well as the rotor 44. By positioning the retainer 100 flush with the end 102 of the shaft 42 and flush with the bearing 80, the commutator 50 as well as the rotor 44 may be easily registered with respect to the shaft 42 and stator assembly 30. Thus, this eases the assembly as well as the placement of these parts within the motor. Also, the retainer 100 minimizes the axial movement of the shaft 42 in the stator 30 due to the enhanced position of the commutator 50 and rotor 44 within the stator assembly 30.

While the above detailed description describes the preferred embodiment of the present invention, the invention is susceptible to modification, variation, and alteration without deviating from the scope and fair meaning of the subjoined claims.

## CLAIMS

1. An armature shaft comprising:
  - a shaft having two ends;
  - a commutator on said shaft;
  - at least one bearing on said shaft, said bearing adjacent one of
- 5 said ends of said shaft, said bearing having a central bore sized to balance said shaft during rotation, said central bore having an enlarged portion; and
  - a retainer on said shaft for retaining said bearing on said shaft, said retainer positioned within said enlarged bore portion of said bearing.
2. The armature shaft according to Claim 1, wherein a bearing housing surrounds said bearing, said housing adapted for fixing with a motor end plate.
3. The armature shaft according to Claim 2, wherein said bearing housing having a receiving bore for receiving said bearing, said receiving bore having a stepped configuration.
4. The armature shaft according to Claim 3, wherein said bearing has an outer surface with a step configuration for seating with said bearing housing.
5. The armature shaft according to Claim 1, wherein said bearing and said retainer being flush with said shaft end.

6. The armature shaft according to Claim 1, wherein a washer separates said bearing from said commutator.

7. The armature shaft according to Claim 1, wherein said enlarged bore portion defines an abutting shoulder, said retainer abutting said shoulder.

8. An electric motor comprising:

a stator assembly;

an armature rotatable within said stator assembly;

a commutator rotatable with said armature and connected to said

armature via a shaft;

brushes associated with said commutator, said brushes held in an end plate;

at least one bearing on said shaft, said bearing adjacent one of said ends of said shaft, said bearing having a central bore sized to balance said shaft during rotation, said central bore having an enlarged portion;

a retainer on said shaft for retaining said bearing on said shaft, said retainer positioned within said enlarged bore portion of said bearing; and

a bearing at the other end of said shaft.

9. The electric motor according to Claim 8, wherein a bearing housing surrounds said bearing, said housing fixed with said end plate.

10. The electric motor according to Claim 9, wherein said bearing housing having a receiving bore for receiving said bearing, said receiving bore having a stepped configuration.

11. The electric motor according to Claim 10, wherein said bearing has an outer surface with a step configuration for seating with said bearing housing.

12. The electric motor according to Claim 8, wherein said bearing and said retainer being flush with said shaft end.

13. The electric motor according to Claim 8, wherein a washer separates said bearing from said commutator.

14. The electric motor according to Claim 8, wherein said enlarged bore portion defines an abutting shoulder, said retainer abutting said shoulder.

15. A power tool comprising:

a housing;

a stator assembly;

an armature rotatable within said stator assembly;

5 a commutator rotatable with said armature and connected to said armature via a shaft;

brushes associated with said commutator, said brushes held in an end plate;

10 at least one bearing on said shaft, said bearing adjacent one of said ends of said shaft, said bearing having a central bore sized to balance said shaft during rotation, said central bore having an enlarged portion;

a retainer on said shaft for retaining said bearing on said shaft, said retainer positioned within said enlarged bore portion of said bearing;

a bearing at the other end of said shaft;

15 a power source electrically coupled with said motor;

an activation member electrically coupled with said motor and said power source for energizing and de-energizing said motor; and

an output coupled with said motor for driving a tool.

16. The power tool according to Claim 15, wherein a bearing housing surrounds said bearing, said housing fixed with said end plate.

17. The power tool according to Claim 16, wherein said bearing housing having a receiving bore for receiving said bearing, said receiving bore having a stepped configuration.

18. The power tool according to Claim 17, wherein said bearing has an outer surface with a step configuration for seating with said bearing housing.

19. The power tool according to Claim 15, wherein said bearing and said retainer being flush with said shaft end.

20. The power tool according to Claim 15, wherein a washer separates said bearing from said commutator.

21. The power tool according to Claim 15, wherein said enlarged bore portion defines an abutting shoulder, said retainer abutting said shoulder.

## ARMATURE SHAFT RETAINER

### ABSTRACT OF THE DISCLOSURE

5 An armature shaft for a motor of a power tool has a shaft with two ends. A commutator is on the shaft. At least one bearing is on the shaft adjacent the commutator end of the shaft. The bearing has a central bore sized to balance the shaft during rotation. Also, a central bore in the bearing has an enlarged diameter portion. A retainer is fixed on the shaft to retain the bearing on the shaft. The retainer is positioned within the enlarged bore portion of the bearing.

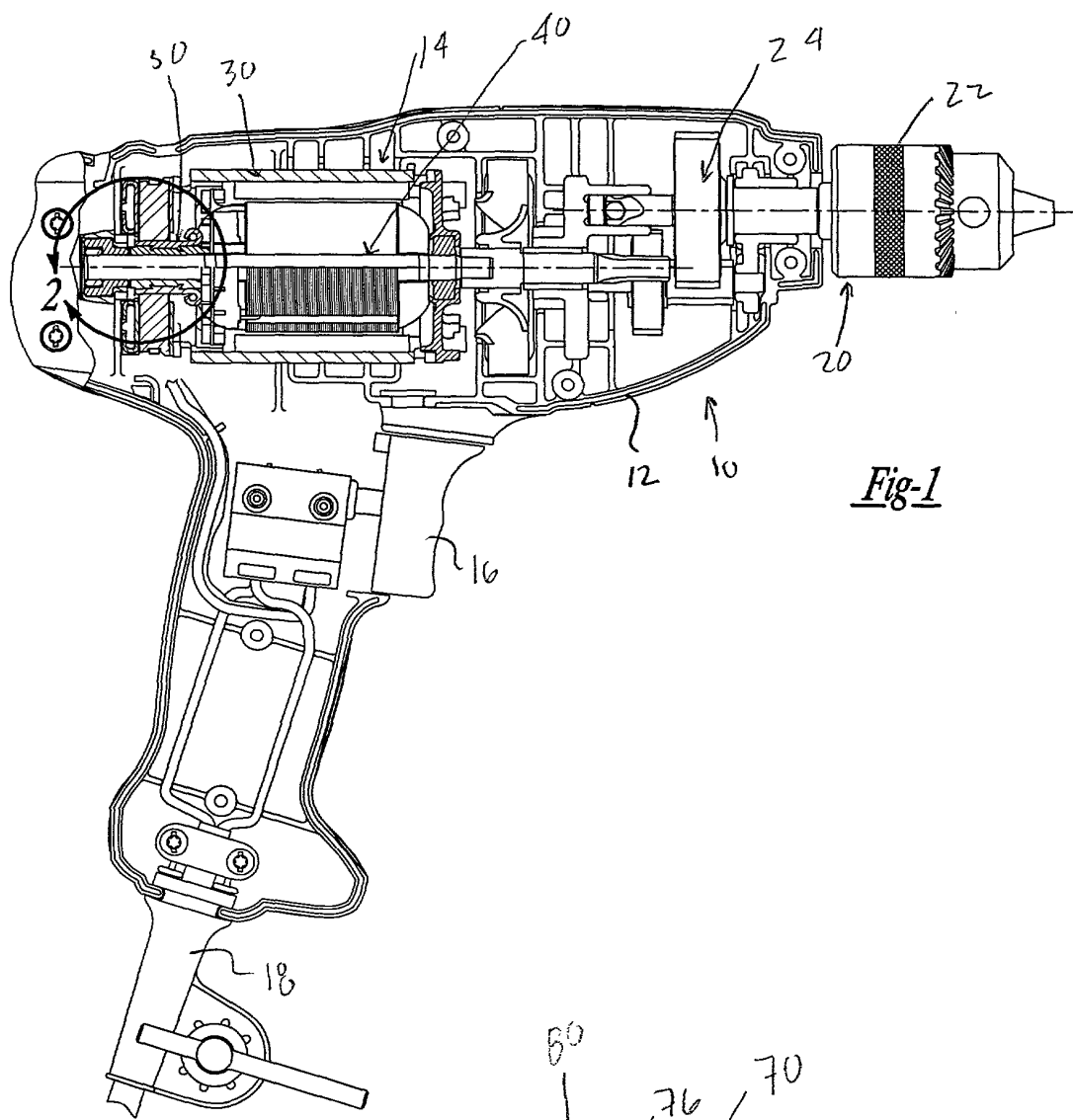


Fig-1

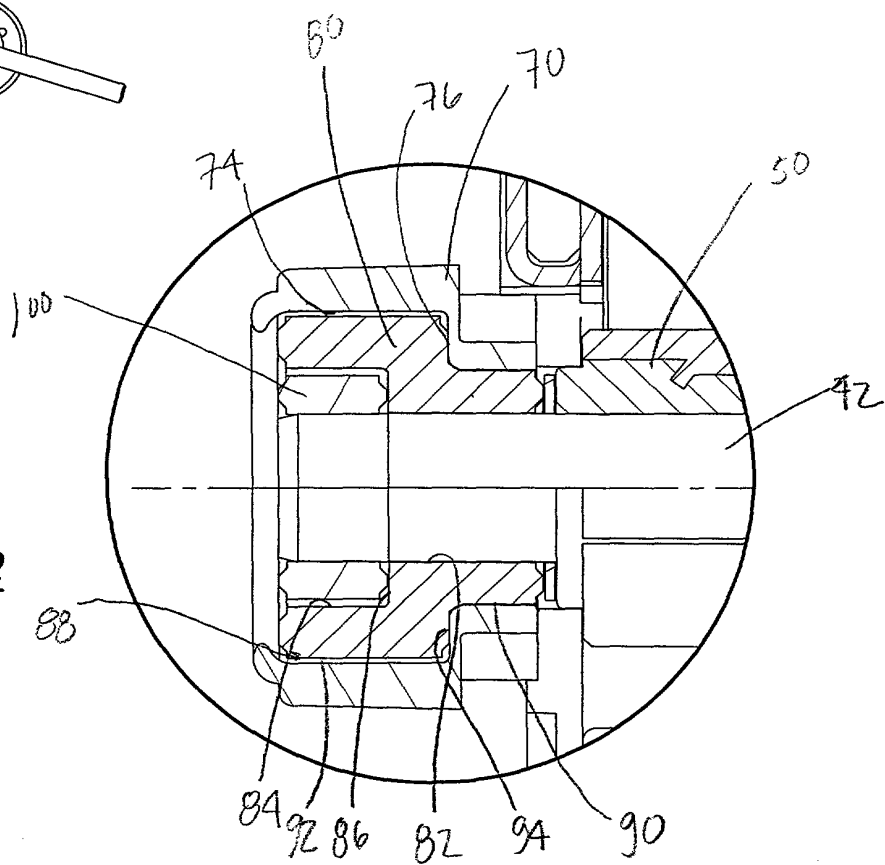
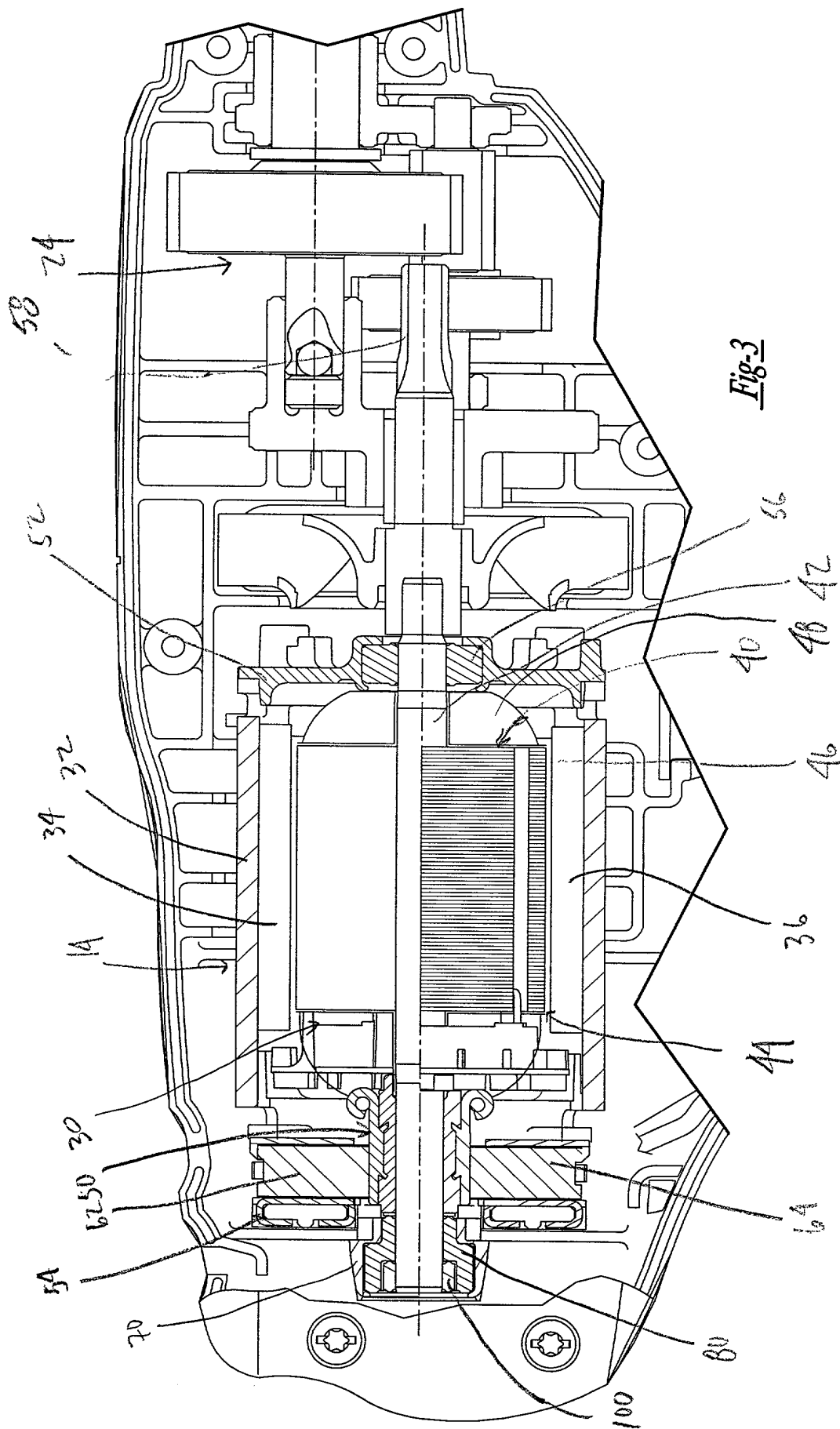


Fig-2





DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

ARMATURE SHAFT RETAINER

the specification of which (check one)

- [ ] is attached hereto.
- [ ] was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, section 119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

			Priority Claim	
(Number)	(Country)	(Day/Month/Year filed)	Yes	No
_____	_____	_____	_____	_____
(Number)	(Country)	(Day/Month/Year filed)	Yes	No
_____	_____	_____	_____	_____
(Number)	(Country)	(Day/Month/Year filed)	Yes	No
_____	_____	_____	_____	_____

## DECLARATION AND POWER OF ATTORNEY

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States Provisional application(s) listed below:

### PRIOR PROVISIONAL APPLICATIONS

\_\_\_\_\_  
(application serial number)

\_\_\_\_\_  
(Month / Day / Year filed)

\_\_\_\_\_  
(application serial number)

\_\_\_\_\_  
(Month / Day / Year filed)

I hereby claim the benefit under Title 35, United States Code, section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status - patented, pending, abandoned
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint Edward D. Murphy, Reg. No. 20625; Harold Weinstein, Reg. No. 20613; Charles E. Yocum, Reg. No. 30121; Dennis A. Dearing, Reg. No. 26653; Bruce S. Shapiro, Reg. No. 33120; and John D. Del Ponti, Reg. No. 24258, of The Black & Decker Corporation, 701 East Joppa Road, Towson, Maryland 21286, telephone (410) 716-3900; and Christopher M. Brock, Reg. No. 27313; W. R. Duke Taylor, Reg. No. 31306, and each principal, attorney of counsel, associate, and employee of Harness, Dickey & Pierce, P.L.C. who is a registered Patent Attorney, my attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith. I request the Patent and Trademark Office to direct all correspondence and telephone calls relative to this application to Harness, Dickey & Pierce, P.L.C., P. O. Box 828, Bloomfield Hills, Michigan 48303, telephone (248) 641-1600.

Full name of first sole inventor: Stephen A. Debelius

First Inventor's signature: \_\_\_\_\_

Date: \_\_\_\_\_

Residence: 13910 Fox Land Road, Phoenix, Maryland 21131

Citizenship: United States of America

Post Office Address: Same as Residence